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THE BETTER USE OF VITAL STATISTICS IN PUBLIC
HEALTH ADMINISTRATION*

BY ARTHUR NEWSHOLME

Since I promised to speak on the subject announced, its apparent inappropriateness to a post-prandial assembly has obtruded itself more clearly on my mind, and I must in actual fact confine myself to a desultory discussion of some elementary considerations which bear on success in the administrative use of vital statistics.

Some years ago you honored me by electing me an honorary member of your Association, and since then I have received regularly your **QUARTERLY PUBLICATIONS**. Their perusal furnishes ample evidence both of the great advance made in this country in statistical study, and of the increased scope and accuracy of your records; and there is evidence of this same advance in the statistical publications issuing from Washington and in many of the reports of state and city health commissioners.

It appears to me to be desirable, in the first instance, to define the position of vital statistics or biometrics in public health teaching and administration. They occupy an essentially subsidiary position, being one of several tools which the public health worker employs in his pursuit of knowledge and measurement of results. To place them on an equal footing with the fundamental sciences of biology, chemistry, and physics, and of pathology, preventive medicine, and epidemiology in public health administration or in an organized program for the training of public health officers appears to me to imply confusion of thought and of plans.

In their present stage of development in most communities, vital statistics form an excellent servant but a very bad master for the

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health officer. They have been invaluable in stimulating and in guiding past public health effort, and especially in directing attention to the areas of excessive general mortality, and of excessive mortality in infancy and from special definite causes of mortality; but medical certification, especially with regard to the more general and so-called constitutional diseases, is still defective, and conclusions based on municipal or national statistics dealing with this certification must be held in suspicion. Even under more definite headings we need to bear in mind the necessary limitations of statistical inference.

Mass statistics give information which is inferior in value to the information derived from the intensive investigation of individual cases — the dynamic method of study. As James Clerk Maxwell said, "however imperfect the dynamic study of man may be in practice, it evidently is the only perfect method in principle," its shortcomings arising not from a faulty method of procedure, but from the limitations of our powers. On the other hand, results obtained by the statistical method "belong to a different department from the domain of exact science."

Many inductions in causation and in the preventive or clinical treatment of disease cannot, with our present knowledge, be expressed otherwise than qualitatively, and yet they are as well established as if they could be stated quantitatively. This is especially true for inductions as to the results of some forms of sanitary and social effort. Two instances may be adduced.

It is often difficult to show any quantitative relation between the amount of sanitary and social effort, and the reduction in the death-rate from tuberculosis. This relation evidently must be one between the total prevalence of the disease and opportunities for its communication on the one hand, and the totality of measures taken or operating for its prevention on the other hand. Were it possible to measure and to weigh exactly the value and the extent of action of each factor concerned, the relation could be shown; but we do not possess adequate knowledge for this purpose. We know, for instance, that the conditions of urban life conduce to increased tuberculosis. We know also that the death-rate from tuberculosis has declined to a greater extent in cities than in country districts. Were we able to state quantitatively the influence and the extent of action of, say, overcrowding, indoor and dusty occupations, dirty habits, etc., in increasing tuberculosis, and of improvements in domestic cleanliness in habits and homes, in greater segregation of the sick, in better factory hygiene, and in higher nutrition in diminishing tuberculosis, we could measure the relative share of each of these factors in the given result in any community. Failing this, as public administrators we possess the wider outlook of

physicians and of students of social phenomena, and we are satisfied that the precise teaching of pathology, the exact scientific experience in Denmark and in this country in the elimination of tuberculosis from herds of cattle, the analogous experience with leprosy, and the facts which we possess, confirming our pathological knowledge and showing historical relation between hospitalization of tuberculous patients in different communities and reduction in the tuberculosis death-rate, all point to the conclusion that to diminish infection from open cases of tuberculosis, and especially to diminish this for infants and for children in the first five years of life, historically has been and administratively now forms the chief means for reducing the mischief done by this great enemy of mankind.

A similar difficulty arises in measuring the value of the medical and hygienic work of health centers and of public health nurses in reducing infant mortality. Did we possess quantitative knowledge of the value of each factor influencing infantile health and disease, and were we able to measure the extent of action of each factor, it would be possible to assess the relative importance of each factor concerned in producing or preventing infantile sickness and mortality. But we usually cannot do this. It is not difficult to show curves of infant mortality for different cities, almost exactly parallel in a long series of years, in some of which health centers and public health nurses have been actively at work, while in others their number has been few or there has been none. Furthermore, such curves are not unnaturally flourished before us by economists, as well as by biometricians, as *prima facie* evidence of the inutility of the educational and medical work of physicians and nurses in child welfare work. But these confident assertions leave us quite cold! Were all the gross mass figures which could be marshalled to point to the conclusion that ignorance is no worse than knowledge, and that domestic cleanliness is not worth while, we should very properly doubt their accuracy or their teaching, not the merits of sanitary education and practice. In actual fact we can by comparison of carefully selected areas in different towns show the value of sanitation and instruction in reducing infant mortality, although—inasmuch as with these two factors other factors are also concerned for which accurate information cannot be tabulated—we are in most instances up against the impossibility of measuring satisfactorily the value of each single factor. In short, in a large part of public health work we must content ourselves with the fact that our work is on the lines which our knowledge of physiology, pathology, and medicine—the institutes of medicine—shows to be important, and reserve to the future the possibility of securing non-fallacious measurements of complex social influences.

Although the examples just cited display my unwillingness to submit to the sole arbitrament of arithmetical standards in the measurement of results of public health work, when pathology and medicine give accurate guidance, I would not convey the impression that vital statistics fail to give most valuable guidance in public health work; they are, indeed, indispensable for such work.

I have always regarded vital statistics as a means to an end, and not an end in itself; and my own first acquaintance with the subject arose out of the need to study these statistics, to which in the third quarter of the last century there was no English guide extant. The publication of my *Elements of Vital Statistics* led to personal contact and correspondence with medical statisticians in many countries—a relationship which became more extensive and more valuable as epidemiological investigations on successive subjects formed my fascinating task.

I recall, for instance, investigations which I undertook into pandemics of rheumatic fever and of diphtheria, in the first of which scarcely any records from America were available; but in diphtheria there was ample evidence from this country showing the natural tendency of diphtheria to be more extensively continental than insular in its incidence, and for its endemic prevalence to be on such a scale as to disguise partially the epidemic characteristics of the disease.

At a later period I recall an international inquiry in which Dr. Stevenson, now the distinguished medical statistician of the English Government, and I were engaged, in which it was desired to obtain corrected birth-rates for different cities, making arithmetical allowance for the proportion of married women in the population and for their age. And it will not be surprising to some of you to learn that the most valuable records available in America were those compiled by Dr. C. V. Chapin for the city of Providence, Rhode Island, records which with similar records from Boston showed that the American born in these cities had reached a position as regards fertility almost as low as that of Paris.

During the last ten years the value and scope of American vital statistics have greatly increased; and in addition to the important publications of the federal and state governments, your literature has been enriched and the borders of knowledge extended by the publications of many workers, including Dr. Hoffman, of the Prudential Insurance Company, and Dr. Louis Dublin, of the Metropolitan Life Insurance Company. To both of these gentlemen I have been indebted for valuable references and information during the last two winters while teaching in the Johns Hopkins University.

Your death-registration area and your birth-registration area have become extended, and the accuracy and completeness of registration have increased, though it is evident that much more needs to be done; and it remains an anomalous fact that in a community which prides itself, and rightly, on its business capacity, and which makes almost a religion of efficiency methods, there is a serious lack of driving power to secure from every community throughout the states the accurate data of births, sickness, and deaths without which periodic vital stock-taking is impracticable. In England Benjamin Ward Richardson could say many years ago in referring to Farr's epoch-making reports that it is "no longer true that pestilence walketh in the dark. It is measured and registered, walketh at last in the open day."

This is becoming more nearly true for the United States, though in many areas there is still inaccurate certification of deaths and classification of the returns in statistical offices is still unskilled; the records of sickness also are imperfect.

A few years ago in many states the registration of births was so incomplete that it was impossible to determine whether any apparent decrease in the rate of infant mortality was real or was due in part or entirely to "drives" which had been followed by improved registration of births! This happily is being improved, but the margin of error in many areas is still a serious handicap in statistical inquiries.

Among the difficulties in the way of an accurate national system of registration of births and deaths in America may be named the following:

1. America is the subject of the vastest experiment in the world's history in mixture of races. Not only has it a large negro population and a not inconsiderable population of the red and yellow races, but Anglo-Saxons, Germans, French, Slavs, Italians, Jews, and other peoples are adding to its population year by year; and although the Anglo-Saxons still predominate, this preponderance will cease ere long unless relative race-birth-rates greatly change, and the largest element on this continent will be no longer Anglo-Saxon. Happily, the American population of the future will still possess the glorious heritage of law and language, of freedom and self-government, and of moral ideals, with which the name of Anglo-Saxon is rightly associated.

With such a conglomerate and mobile population, with problems of digestion and assimilation of foreign elements on an enormous scale, it is not surprising that registration of births and deaths, with its possibilities of measuring the relative vitality and social progress of different social elements, has been neglected. It is none the less a misfortune for humanity that accurate and complete records have not

been kept of the greatest social and sanitary experiment in the world's history.

2. The state sovereignty of each of the forty-eight states has been inimical to the compilation of accurate comparable national statistics. The Bureau of Vital Statistics in the Department of Commerce of the federal government publishes annual reports which year by year are increasing in value; but water cannot spontaneously rise above its own level, and these reports have no higher value than that of the records of each individual state. Although the international rules as to classification of deaths are well known, what certainty have we that in the majority of these states these rules are rightly followed in the allocation of deaths to their appropriate heading? It would probably be impracticable for the federal government, in view of the magnitude of the task and the separate sovereignty of each state, to arrange for a federal as well as a state analysis of every single death in the country, thus ensuring exactly comparable data. This has been done in England, thus giving an accurate check on the locally published vital statistics for every sanitary area throughout the country, and rendering these statistics of local mortality comparable with those for all other areas.

3. In the majority of states the lack of civil service conditions of appointment and tenure of office of the statistical superintendent has, I gather, meant much inefficient work. This is preëminently an appointment in which evidence of competence for the post should be demanded. The majority of state statisticians in the past have been untrained physicians, with no special interest in the compilation of accurate statistics; they were not concerned with enforcing the law of registration, and were ignorant of the principles of death certification and classification.

In the General Register Office in London there is a medical statistician, a worthy successor of Dr. Farr, who has associated with him a staff competent to undertake all the needed tabular work, and who can call in the services of actuarial consultants when required. This secures a due performance of the work of registration, tabulation of results, and commentary on the classified results. The knowledge of a fully trained scientific physician, and an adequate training in the principles of death certification and of the classification of diseases, are indispensable in collecting and in utilizing vital statistics; and many well-intentioned investigations by biometricians, so-called, have shown what ridiculous results may be published in the absence of accurate pathological and medical knowledge. Complexes are treated as individual entities; "constitutional diseases" occupy the stage, although this term has ceased to have a definite and exact meaning in modern pathology.

Similarly, "heart diseases" and "renal diseases" are used in comparisons, as though each of these complexes had a single and simple, instead of a multifarious, causation. The constitutional factors and the organic fitness of the population are the subject of pseudo-learned disquisition, in happy ignorance of the elementary facts that the majority of so-called constitutional diseases—possibly all—are due to poisoning or infections derived *ab extra*, and that cardiac and arterial diseases, for instance, owe their origin chiefly to infections, of which syphilis and rheumatic fever are far and away the most important.

Incidentally, although we may properly attach importance to the hygiene of middle life and to periodical medical examinations as means to aid in preventing, or in securing the early treatment of, illness, it is well to bear in mind that the prevention of breakdown in early and late middle life is much more wrapped up with the prevention of the infections of childhood, of adolescence, and of early adult life than with any other factor that can be named. In substantiation of this statement I need only mention tuberculosis and syphilis, which together probably are responsible for one out of every five deaths from all causes at all ages in the aggregate.

4. It is unfortunate that in some states, including, I believe, Massachusetts, Ohio, and Michigan, the registration of births and deaths is not in charge of the Public Health Department of the state; and that ready access of each health officer to the vital statistics of his area may thus be a matter of grace not of right, sometimes of belated grace.

5. As far as I can ascertain, it has not been found practicable to relegate institutional deaths to the vital statistics of the place of usual residence of the deceased. In England Dr. Stevenson and I were able to organize a successful system by virtue of which the General Register Office in London has become a clearing house, and all deaths of non-residents, institutional as well as others, are referred to the area in which the deceased lived. Prior to this, curious errors occurred. An area in which a large maternity institution existed had a terrible infant mortality; and a city which prided itself on its low tuberculosis death-rate and ascribed this low mortality to its dispensary machinery, had its tuberculosis hospital for advanced cases outside the city boundary! To what extent such blunders occur in America, I cannot say. Its dimensions and population are probably too vast to admit of a federal system of relegation of deaths of outsiders; but it might be done for each state. In passing I would deprecate the imperfect correction for deaths of visitors which was commonly practiced in England prior to the institution of the system I have indicated. Health officers very

willingly excluded institutional deaths of visitors, but were less willing to add outside deaths belonging to their area!

6. In sickness registration I had the privilege of initiating one of the most valuable reforms in England, viz., the weekly tabulation in the offices of the Local Government Board (now the Ministry of Health) of the number of cases of each of the notifiable infectious diseases in every one of the 1,800 sanitary areas in England and Wales, and their publication and distribution within three or four days to every health officer. For some fourteen years these have now been summarized in an annual return, thus presenting one of the most valuable epidemiological mines of information extant. The weekly returns of cases circulated from Washington by the Public Health Service are a step toward securing similar statistics in this country; and in this connection should be mentioned the valuable relation established between the federal and state health services by the appointment of officers of the latter as collaborating epidemiologists.

7. A striking lack in the vital statistics of the United States is with respect to housing accommodation. The decennial census returns in England enable health officers to ascertain for all cities and larger areas the number of inhabited houses in each ward, the number of families living in one, two, three, four or more rooms, the number of rooms in each of these groups in which there are on an average more than two persons per room, and whether the overcrowding is of children or of adults. This information has important social significance.

8. I do not propose to discuss the difficulties which must obviously arise federally from having the responsibility for vital statistics divided between several federal departments; nor those which arise from the county control of collection of statistics in some states. I merely state the general proposition in which all familiar with the importance of the subject and the fundamental need for uniformity of method in securing data and in classifying the data when obtained will agree, that *centralized administration on a large scale is essential if accurate and strictly comparable statistics are to be obtained.*

It is equally necessary that every health officer of every state, of every county, and of every city or smaller community should receive at least weekly full particulars of every birth and death occurring within his area, and should receive daily notifications of every case of infectious disease occurring within his area.

The preceding very imperfect review of the situation may be supplemented by some further suggestions—obvious, but none the less important—for making the statistics of each state and of every area within the state increasingly useful in the service of the community. Vital

statistics are merely a means to an end. Their value consists in the light which they can throw on the prevalence of disease and on the means for diminishing its incidence.

I have not seen a state public health report in which the possibilities of utility of vital statistics have been fulfilled, although many such reports approach this goal, and still more contain much valuable material. It is necessary to bear in mind, however, that a heap of bricks does not constitute a house; and that undigested statistical matter should preferably be filed in the statistical bureau for further reference and treatment, and not presented in expensive and repellent tables to a public which is quite properly unsympathetic to such matter.

There is need for detailed study of the vital statistics of every city and state by men who have adequate medical knowledge, who can avoid the elementary pitfalls of statistics, and who above all are enthusiastically obsessed with the public health possibilities in the careful study of local statistics. In statistical work there has been, hitherto, too much shovelling into heaps, and too little building of the edifice of public health. No elaborate mathematical work is needed for the study which I am advocating, or for ordinary public health needs; but it is necessary that there be an observance of the well-known rules of statistical accuracy and of sound reasoning, based on scientifically established pathological and medical knowledge, and made with an enthusiastic desire to *make statistics act as a pointer* to the areas in which excessive mortality or sickness exists, in order that—an intensive study of its vital statistics having been secured—a corresponding social and sanitary investigation may follow and the appropriate remedy may be applied.

Such intensive studies are of special immediate importance in relation to the *mortality of maternity, infant mortality, and mortality from tuberculosis*. I am assuming that the sanitary index formed by typhoid fever and the important index of domestic cleanliness which the prevalence of infantile diarrhoea supplies, are kept constantly under supervision.

Together with these two, there are no more important indices of the welfare of a community than the three named above; and it ought to be practicable to state, year by year, for every area and every subdivision of an area, *e. g.*, each ward of a city, the mortality associated with child-bearing, the total and the neo-natal infant mortality (*i. e.*, under one year old and under one month old) in terms of births, and to take public health action in accordance with the findings. Hence the essential importance of complete birth registration. And it is not reassuring to find that in the year 1916 in the New England

states there were revealed the following degrees of defective birth registration. There were no birth certificates in the case of 15.2 per cent in Connecticut, 9.5 per cent in Maine, 8.7 per cent in Massachusetts, 5.6 per cent in New Hampshire, 18.3 per cent in Rhode Island, and 5.7 per cent in Vermont, of the infants who died under the age of one year. Allowing for migration of infants from without each state, which must be small in amount, these figures cannot be regarded as satisfactory.

How much more effective would be the work of our public health nurses and at our health centers if the work were concentrated particularly on the infants in areas in which intensive statistical studies show that infant mortality is heaviest; and how much better directed and therefore more successful would be that work in the diminution of neo-natal mortality if every health officer had it forced on his attention that in some parts of his area the loss of life in the first month of extra-uterine life may be twice as heavy as in other parts; and if instead of futile observations as to the relative importance of "congenital debility," "prematurity," "marasmus," or the like in the death returns—which are mere labels of inexactitude of knowledge—and instead of the theoretical and generally unfounded assumption that deaths occurring at this tender age are unavoidable, assistance were given which would secure adequate care of the mother in pregnancy, in parturition, and during the critical first month after birth. It may of course be argued that unless we know the causes of this early infant mortality we cannot act intelligently against it. Such a statement illustrates well the difference between the arm-chair statistician and the competent physician engaged in public health work. The latter knows, for instance, that syphilis is responsible for a large share of this early infantile mortality, although it but seldom emerges in death certificates, and that its maleficent action on foetal tissues can be prevented. He knows, again, that many of the fatal conditions, which cannot as yet be expressed in exact pathological terms, do not arise when appropriate medical, nursing, and domestic assistance are provided for the expectant, parturient, and nursing mother. The statistical differences in neo-natal mortality, and it may be added in the number of still-births in different areas amply confirm this conclusion.

The definition of still-births adopted in different states varies, and apart from this there are large differences in the extent to which such births are registered; and to propose, as has been done, to state puerperal mortality in terms of total including still-births, instead of in terms of live-births, is to depart from the nearest approach to an accurate denominator for the rate hitherto available.

In conclusion let me—while expressing my appreciation of the essen-

tial role of vital statistics as an instrument in extending our knowledge of the epidemiology and social history of each disease (its social history is really a part of its epidemiology), in estimating the relative position of different communities, and in assessing the value of sanitary and social work—deprecate the statistical use of groups of diseases, of multiform and heterogeneous origin, for comparative purposes as being just as unscientific as it would be for the biometrician or the chemist to insist or even to permit himself to study the properties of hydrogen in the contents of a jar containing a mixture of this gas with half a dozen other gaseous elements.

I further press the point that vital statistics can have no higher value than that of the individual death certificates on which they are based; that no conjuring with classifications will render indefinite and dubious data other than they are; and that the only line of safety in most instances is to study each certified cause of death independently and separately.

I would, finally, emphasize the important consideration that when statistics having only a qualitative and compound value are being studied, and when the factors concerned cannot—as is so often the case—be analyzed quantitatively, we are justified in denying, indeed it is our duty to deny, the value of “biometrical” work based on such data, and in resting our inferences and our administrative action, as guardians of the public health, on a careful balance of all available evidence, giving chief place to exact physiological and pathological evidence bearing on our problem.